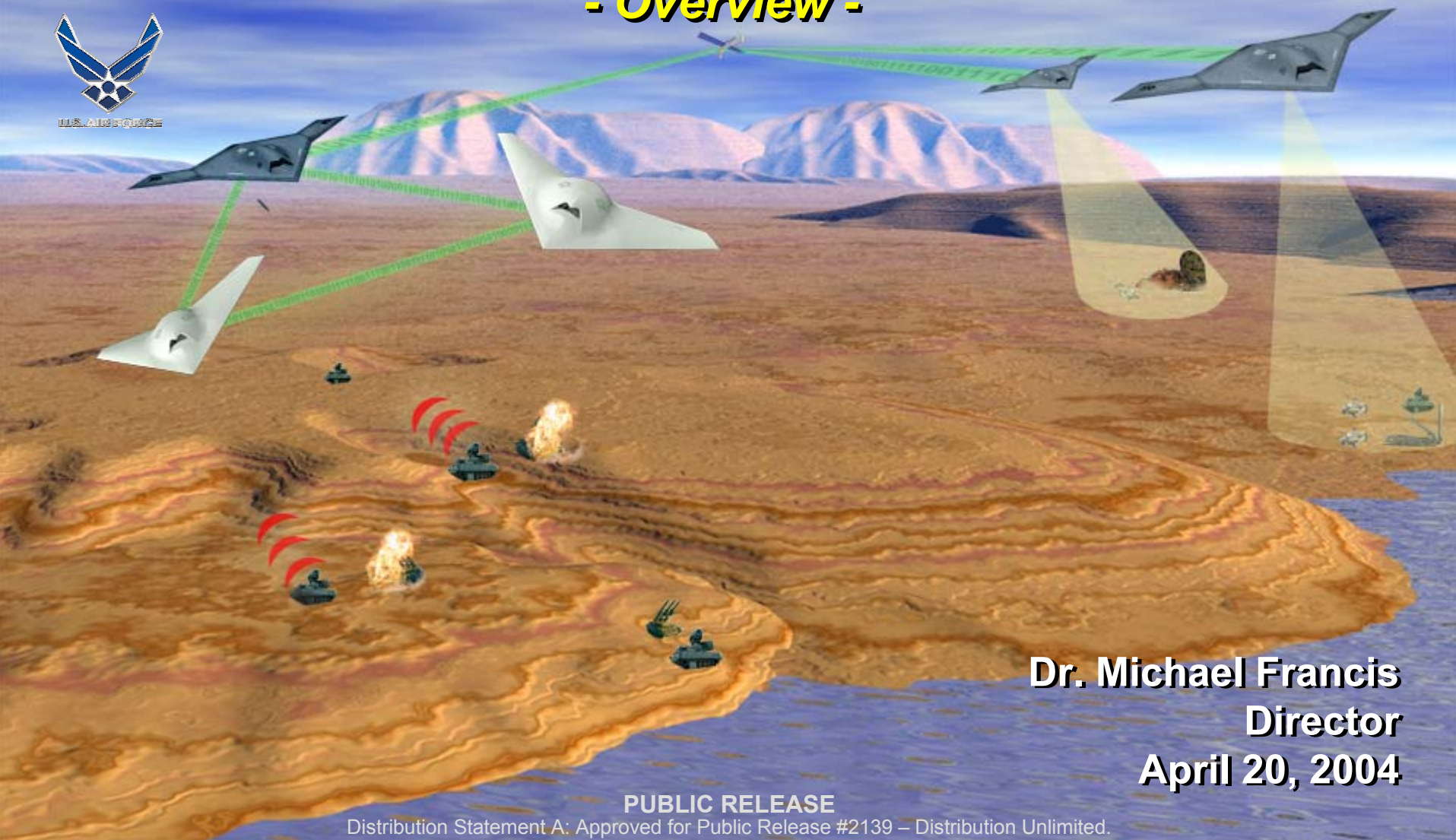




Joint Unmanned Combat Air Systems

Capability Demonstration Program

- Overview -



Dr. Michael Francis
Director
April 20, 2004

PUBLIC RELEASE

Distribution Statement A: Approved for Public Release #2139 – Distribution Unlimited.

Purpose



- **Acquaint You with the J-UCAS Program**
- **Describe the *Common Operating System (COS)* and Our Plan to Develop It**
- **Describe the Integrator/Broker Role in COS Development**
- **Discuss Potential Technology Contribution Opportunities**



Joint Unmanned Combat Air Systems -- Unique Joint Program

- **DARPA-Air Force-Navy Joint Development Program**
 - Effective 1 Oct 2003 ... Program Office in Arlington, VA
- **Outgrowth of Earlier DARPA Programs**
 - Uninhabited Tactical Aircraft (UTA) – 1994-1996
 - DARPA-USAF Unmanned Combat Air Vehicle (UCAV) – 1997-2003
 - DARPA-Navy Unmanned Combat Air Vehicle (UCAV-N) – 2000-2003
- **Network-based System-of-Systems**
 - Focus on Operational Capabilities ... Specific Mission Applications
 - 2 Prime Contractors -- Boeing (X-45), Northrop Grumman (X-47)
- **Atypical Program Architecture**
 - Spiral Development ... Cutting Edge Technologies ... ATDs
 - Operational Assessment ... Exploration/Demonstration of Capabilities
 - Aggressive Timeline ... FY07 for Start of the “OA”
- **Large Program - \$4B+ over the FYDP**

PUBLIC RELEASE

Distribution Statement A: Approved for Public Release #2139 – Distribution Unlimited.

Program Evolution

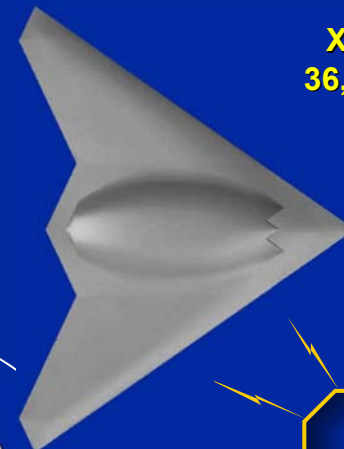


X-45A
12,000 lb

DARPA-USAF UCAV ATD



X-45B
24,000 lb



X-45C
36,000 lb



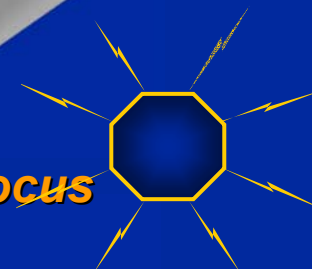
X-47A
5,000 lb

DARPA-Navy UCAV-N

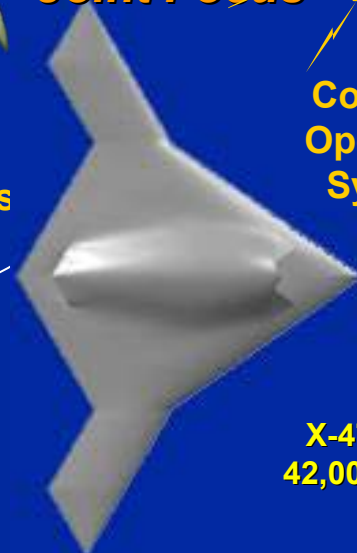


**Common Sensors
& Weapons**

Joint Focus



**Common
Operating
System**



X-47B
42,000 lb

FY99

FY00

FY01

FY02

FY03

PUBLIC RELEASE

Distribution Statement A: Approved for Public Release #2139 – Distribution Unlimited.



J-UCAS Capability Demonstration Program -- *The Vision*



SEAD/Electronic Attack



Surveillance



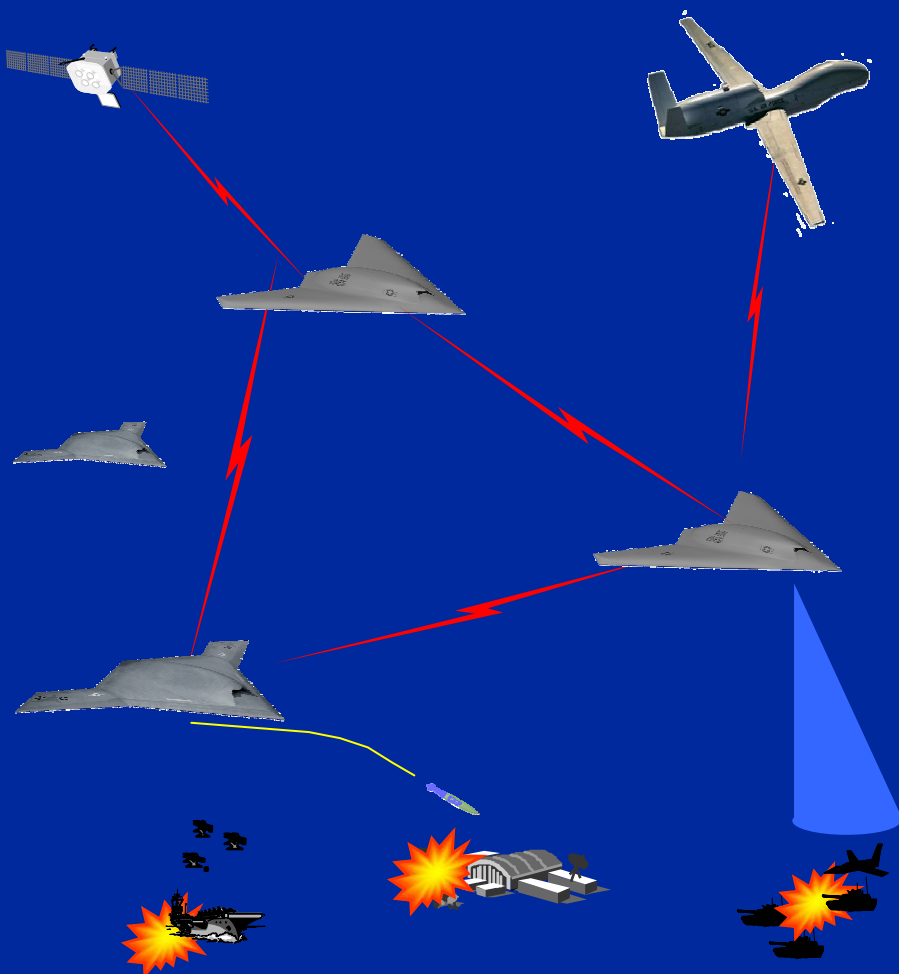
Deep Strike

- **Versatile Combat Capability**
 - Multi-Mission Adaptability
 - Global Operations
- **Manned Force Augmenter**
 - Unique, Difficult Missions
 - Operational Synergy
 - Force Amplification
- **Network-Centric Operations**
 - Network-based Architecture
 - Multi-Vehicle Collaboration
 - High Levels of Autonomy
 - Flexible Human Intervention
 - Enhanced Situation Awareness
 - Dynamically Adaptive System
 - Predictable Battlefield Effects
 - ... Unpredictable Tactics
- **Affordable System-of-Systems**
 - Common Operating System
 - Air Vehicle Compatibility
 - Reduced Support Costs

PUBLIC RELEASE

Distribution Statement A: Approved for Public Release #2139 – Distribution Unlimited.

Collaborative Operations



Increase System Versatility

- Deep/Denied Environments
- System-of-Systems Threats
- Multiple Engagement Options
- Diverse Missions

Improve System Performance

- Reduced Target Location Time
- More Assured Target Identification
- Sustained Ground Tracking
- Improved Targeting Precision
- Rapid Battle Damage Assessment

Enhance Survivability

- Group Self Defense Tactics
- Novel CONOPS (e.g. Bi-static Ops)
- Graceful System Degradation

PUBLIC RELEASE

Distribution Statement A: Approved for Public Release #2139 – Distribution Unlimited.



Global Capabilities— SPACE AS INFRASTRUCTURE

Navigation

Communications

“Reach Forward –
Reach Back”

- Remote Sensing (Collaborative)
- Missile Warning

Global Operations

- Airspace Deconfliction
- Large # of Platforms
- Coordinated C2-ISR
- Near Real Time

Theater C2

PUBLIC RELEASE

Distribution Statement A: Approved for Public Release #2139 – Distribution Unlimited.



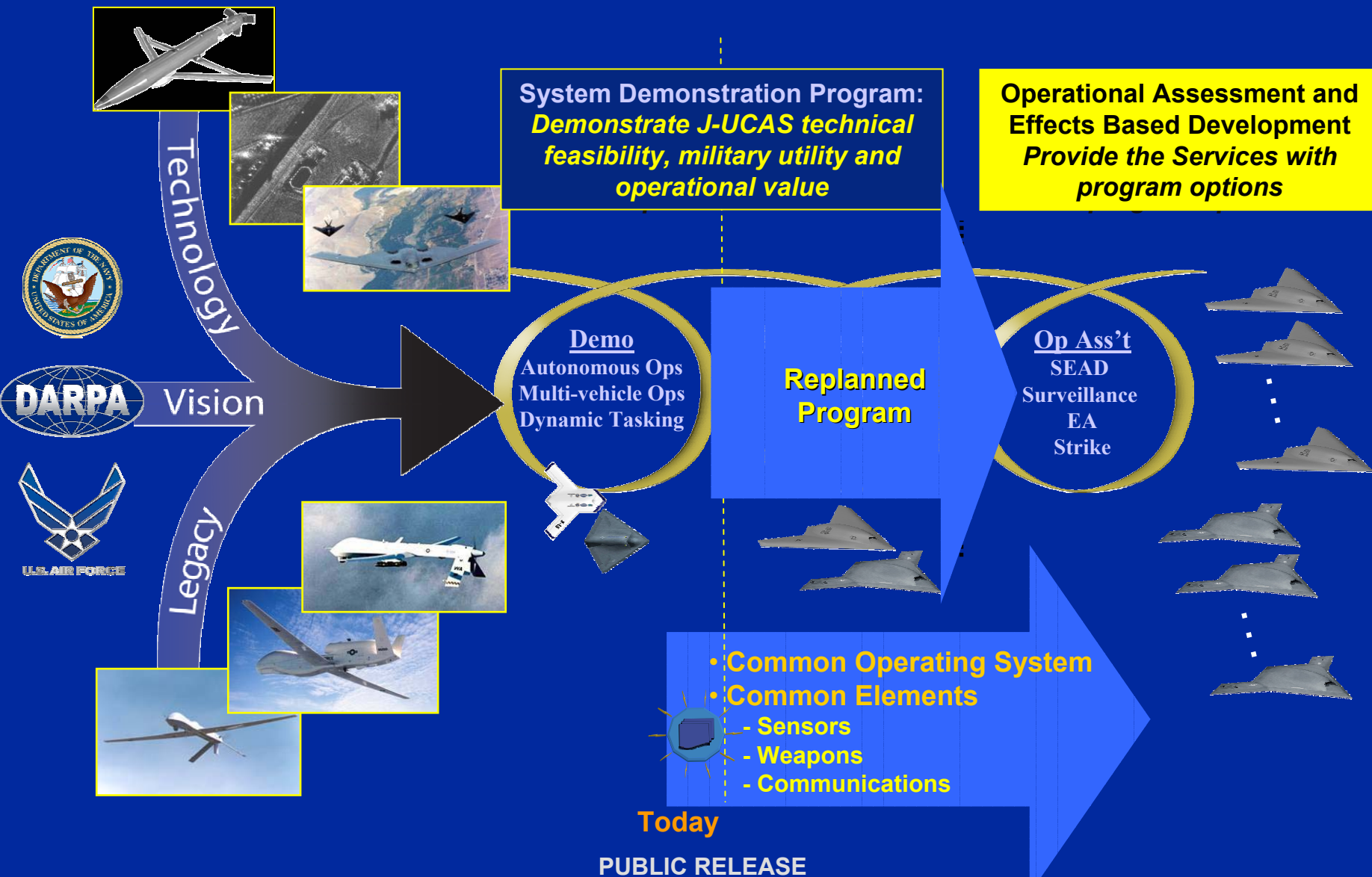
Program Direction & Expectations

- ***OSD Objectives (23 Jun 03 USD/AT&L Memorandum)***
 - Demonstrate Feasibility & Flexibility Of The J-UCAS Concept
 - Conduct Joint Operational Assessment Of J-UCAS Capabilities
 - ***OA In FY07-09 Timeframe ... Facilitate Early Service Decision***
 - Maintain Competitive Environment Throughout The Program
- ***Service OA Expectations (OA Capability Statements)***
 - Diverse Mission Priorities
 - ***USAF – SEAD / Electronic Attack***
 - ***Navy – Persistent Surveillance / Reconnaissance (Deferred)***
 - Demanding Air Vehicle Characteristics
 - ***Range / Radius / Endurance***
 - ***Payload Options – Type / Weight / Volume***
 - ***Signature – LO To The Next Level***
 - ***Air Refueling***
 - ***Carrier Suitability (Navy)***

PUBLIC RELEASE

Distribution Statement A: Approved for Public Release #2139 – Distribution Unlimited.

J-UCAS Program



PUBLIC RELEASE

Distribution Statement A: Approved for Public Release #2139 – Distribution Unlimited.

Successful 1st Generation Air Vehicles



X-45A Guided Weapons Drop



X-47A First Flight



- **X-45A Accomplishments**
 - First Flight – May 02
 - Max Altitude / Max Speed – Feb 03
 - Multi-Vehicle Ground Tests – Feb 04
 - Guided Weapons Release Demonstration Apr 04
- **Software Develops Critical J-UCAS Functionality**
 - Vehicle Decision Making
 - Multi-Vehicle Collaboration
- **X-47A Accomplishments**
 - First Flight – May 03
 - Low Speed Aerodynamics & Flying Qualities
 - Carrier Landing Systems Compatibility
- **Design Leverages Global Hawk And Fire Scout Experience**

PUBLIC RELEASE

Distribution Statement A: Approved for Public Release #2139 – Distribution Unlimited.

Toward Operational Air Vehicles



Challenging Objectives

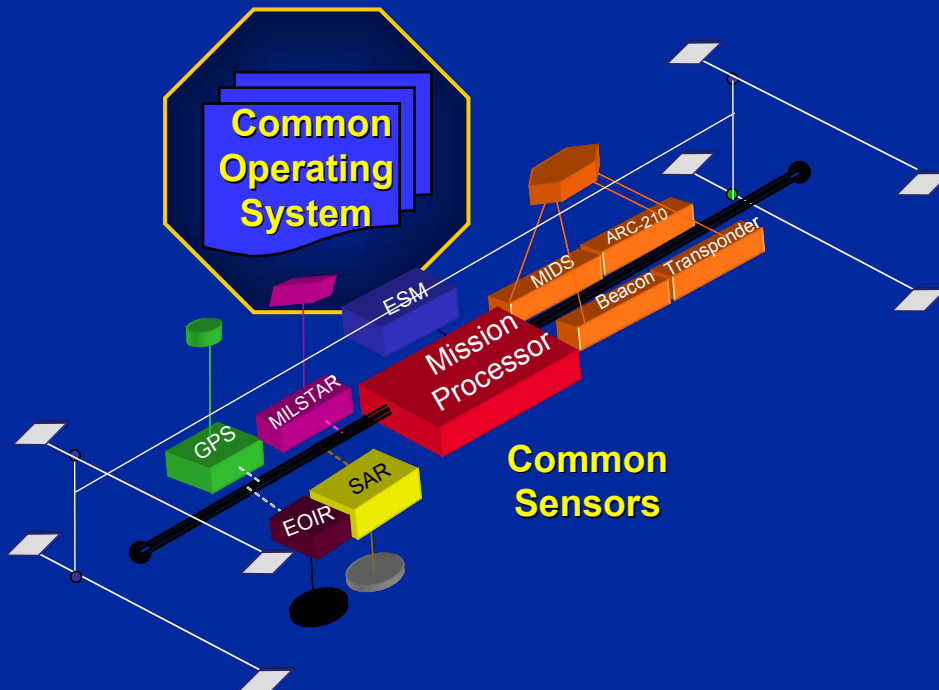
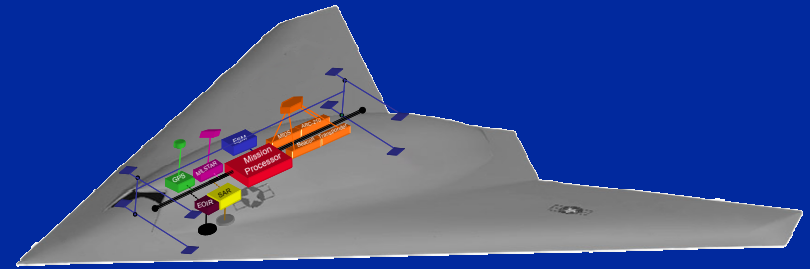
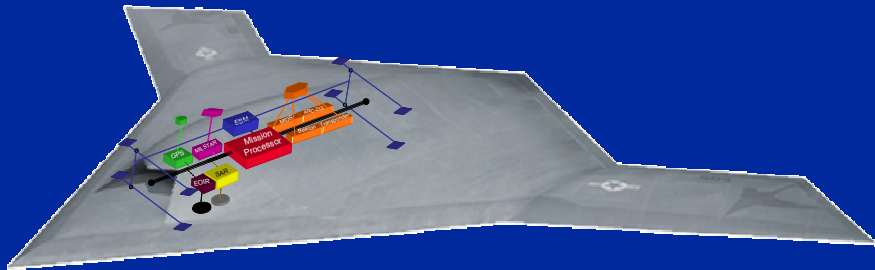
- **Long Range – Combat Radius**
 - 1300 nm with 4500 lb Payload
- **Significant Endurance/Persistence**
 - Demo System: 1000 nm / 2 hrs loiter
 - Objective System: 1000 nm / 3.5 hrs loiter
- **Sizable Payload**
 - Size / Volume & Weight - 4000# - 2 JDAMs
 - Multiple Weapons / Sensor Pallets
- **High Platform Survivability**
- **Versatile Sensor Suite**
 - ESM Capability
 - Synthetic Aperture Radar
 - EO / IR Sensor
 - EW / Electronic Attack Payload
- **Carrier Suitability**
 - Catapult Launch
 - Arrested, 3rd Wire Landing
- **Global Operations**
 - Air Refuelable
 - Civil Airspace Compatible



PUBLIC RELEASE

Distribution Statement A: Approved for Public Release #2139 – Distribution Unlimited.

Common Systems & Technologies



- Common Operating System
- Communications Capability
- Sensors
- Weapons
- Avionics Hardware (e.g. Processors)

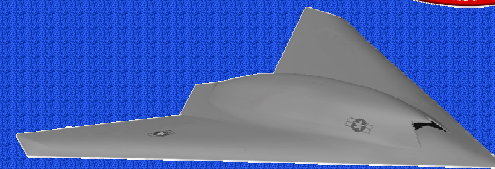
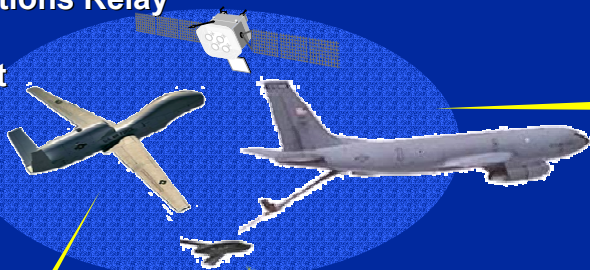
PUBLIC RELEASE

Distribution Statement A: Approved for Public Release #2139 – Distribution Unlimited.

J-UCAS System Elements

Operational Infrastructure

- Communications Relay
- Navigation
- Sustainment
- Transport



Platform/Vehicle(s)

- Mission-Tailored Design
- Vehicle Management
- Vehicle Autonomous Functions

Communications

- Secure Links/Network
- LOS or BLOS Ops



Control Station(s)

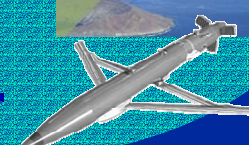
- Physical HSI (Displays, I/O, ...)
- Launch/Recovery Control
- Vehicle-Payload Operations
- Human Crew

Operating System

- System C2 & Interfaces
- Comms Management
- Mission Planning
- Autonomous Functions
- Health/Status
- Logical HSI ...

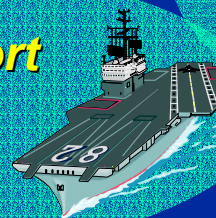
Payload Systems

- Sensor(s)
- On-Board Processing
- Data Relay
- Weapons



Direct Support

- Maintenance
- Logistics
- Launch/Recovery Infrastructure



PUBLIC RELEASE

Distribution Statement A: Approved for Public Release #2139 – Distribution Unlimited.

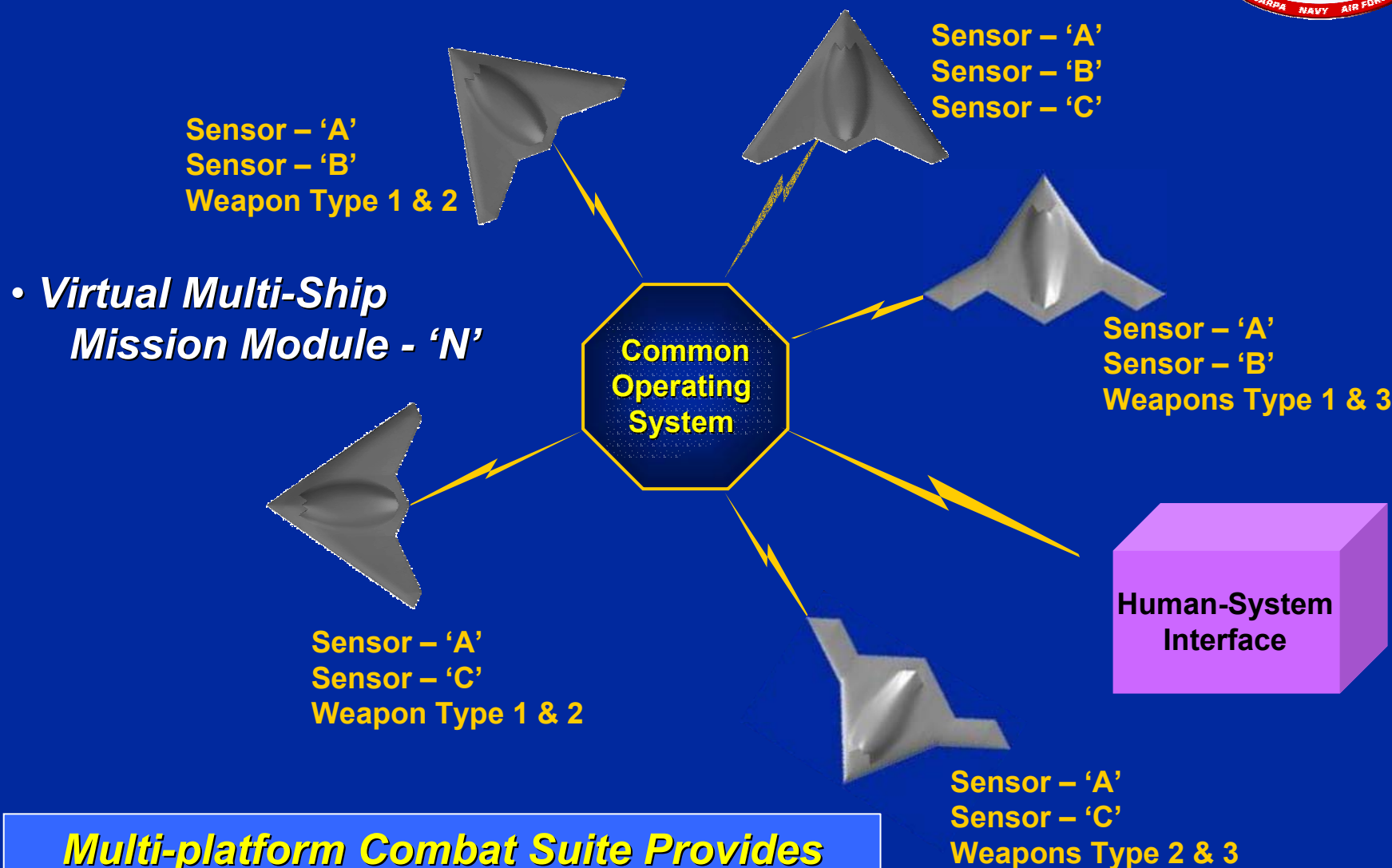
Common Operating System



PUBLIC RELEASE

Distribution Statement A: Approved for Public Release #2139 – Distribution Unlimited.

Joint Unmanned Combat Air System



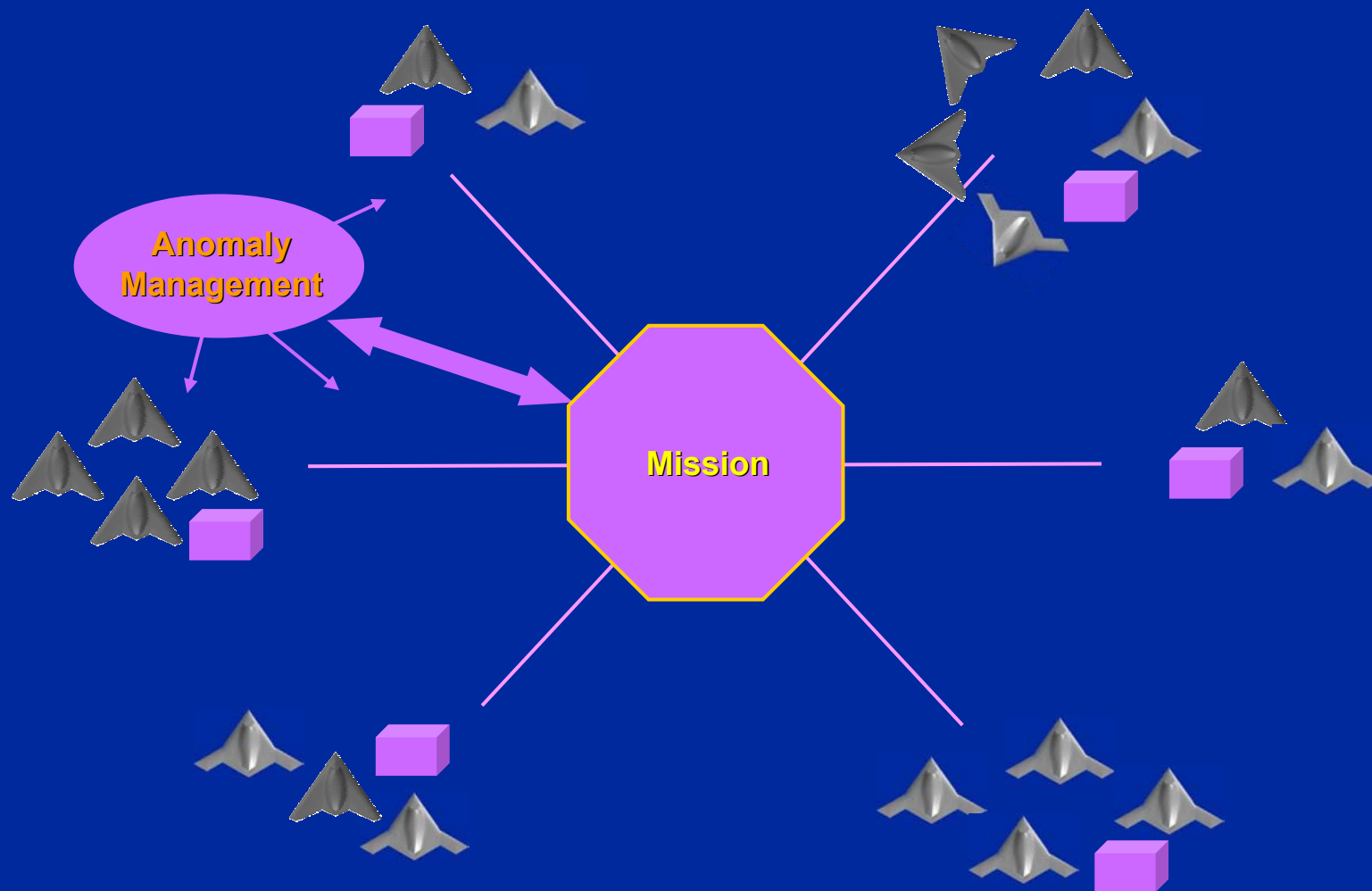
PUBLIC RELEASE

Distribution Statement A: Approved for Public Release #2139 – Distribution Unlimited.

Joint Unmanned Combat Air System



New CONOPs and Tactics Possible ...



PUBLIC RELEASE

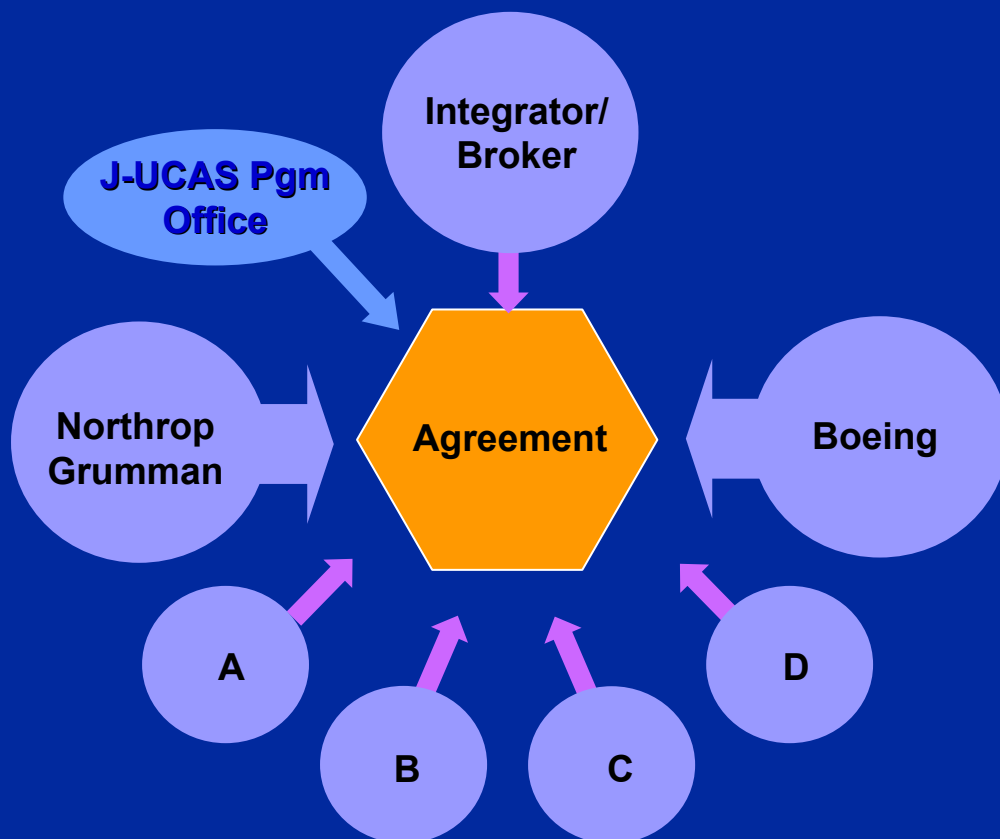
Distribution Statement A: Approved for Public Release #2139 – Distribution Unlimited.

Common Operating System



3 Levels

Consortium-like Business Arrangement



• Integrator/Broker/Observer

Unique Role ... Not an LSI ... No Other Integrator ... Facilitator ... Referee
No Intellectual Property

• Program Primes – Key Stakeholders

Fractional Ownership
Platform Integrators – Physical, Functional
S/W Developers
COS Collaborators

• Other Contributors

Based on Potential Contribution(s)
Small Houses, Other Primes, Traditional Subs, Commercial Providers

**Business dynamics promote competition & ownership ...
Increased idea pool decreases technology risk**

PUBLIC RELEASE

Distribution Statement A: Approved for Public Release #2139 – Distribution Unlimited.

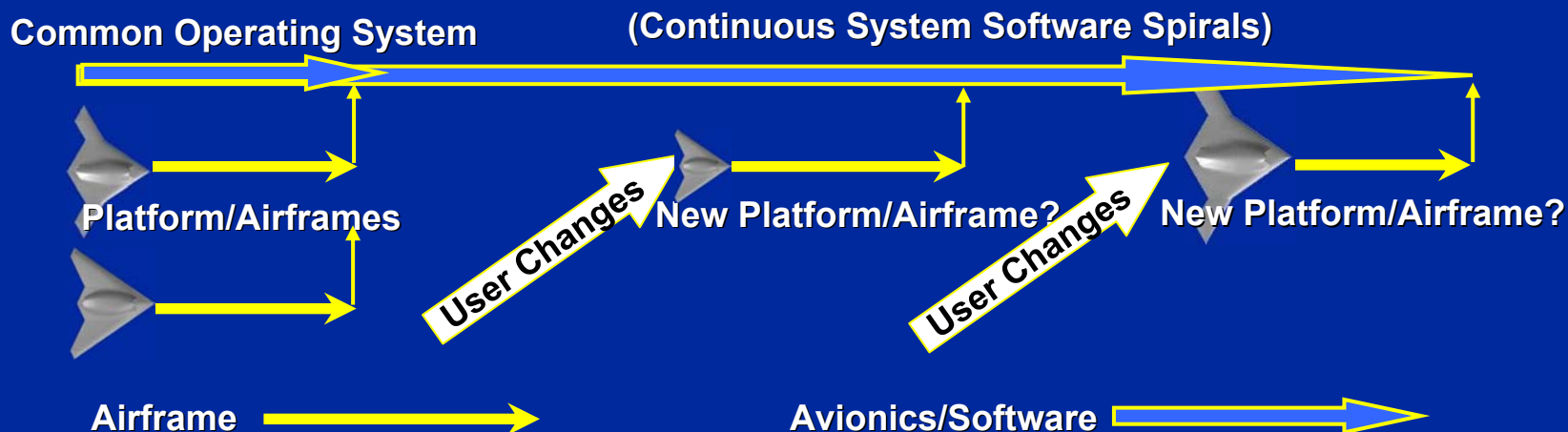
Decoupling the Operating System



Traditional System Development



J-UCAS System Development Concept



PUBLIC RELEASE

Distribution Statement A: Approved for Public Release #2139 – Distribution Unlimited.

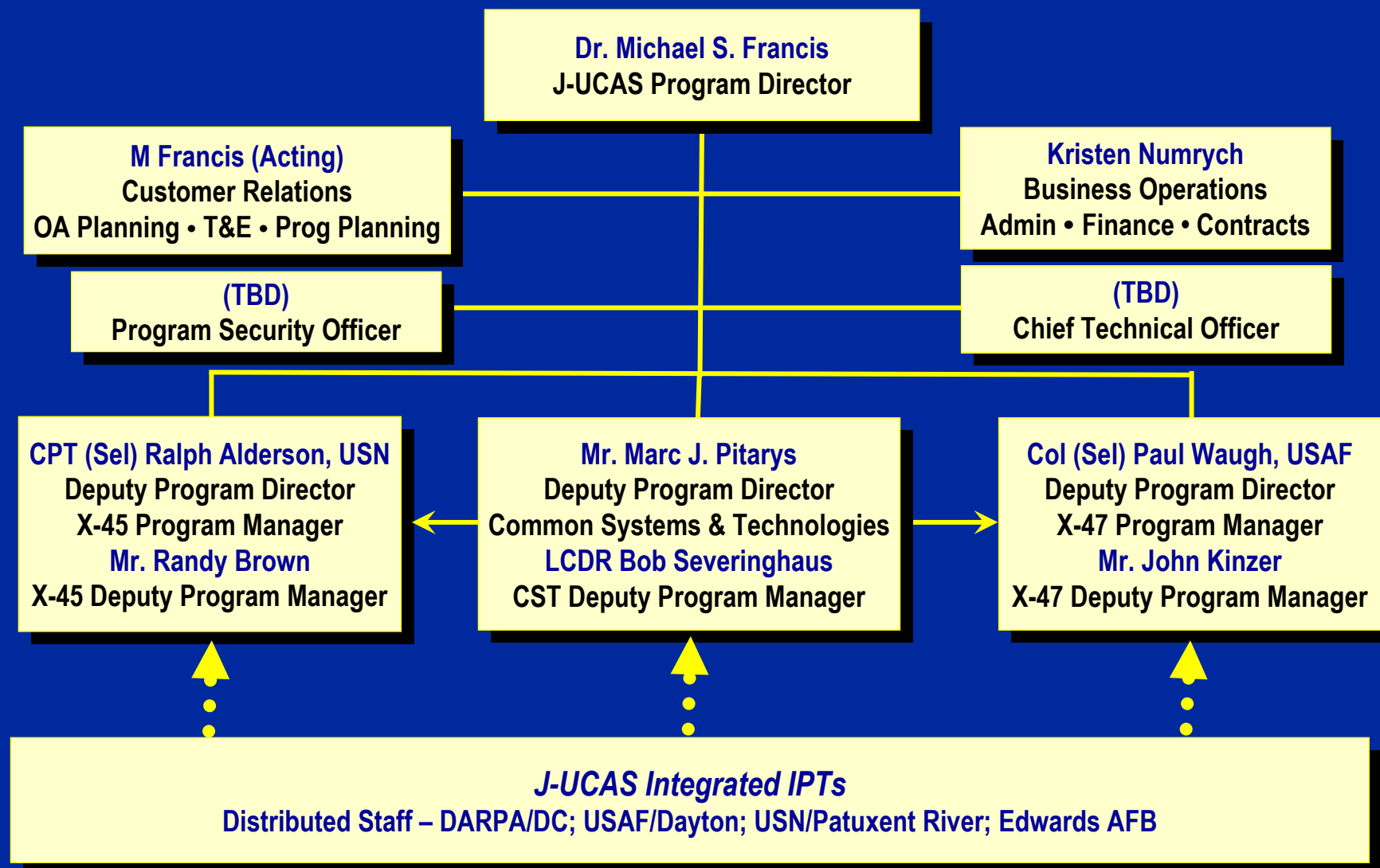
Challenges



- **Significant Technical Hurdles ... Demanding Schedule**
 - Achieving Integrated System Performance and Capabilities
 - **Complex, State-of-the-Art Air Vehicles**
 - **Operating System Flexibility and Versatility ... Including the Human Element**
 - Taking Full Advantage of the Technologies
 - Understanding & Reducing System Vulnerabilities
- **Overcoming Institutional & Cultural Inertia**
 - Building User Trust in the Systems & Technologies
 - Improve User Willingness to Adapt ... Exploit New Opportunities
 - Integration Into the Global Airspace
- **Maintaining a Focus on Affordability**
 - Resisting Requirements Creep ... Tendency to Increase Size & Complexity
 - Continuous Focus on Cost Issues

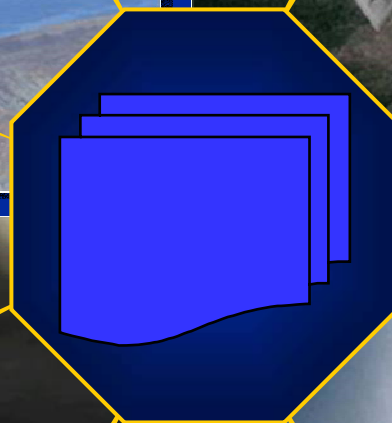
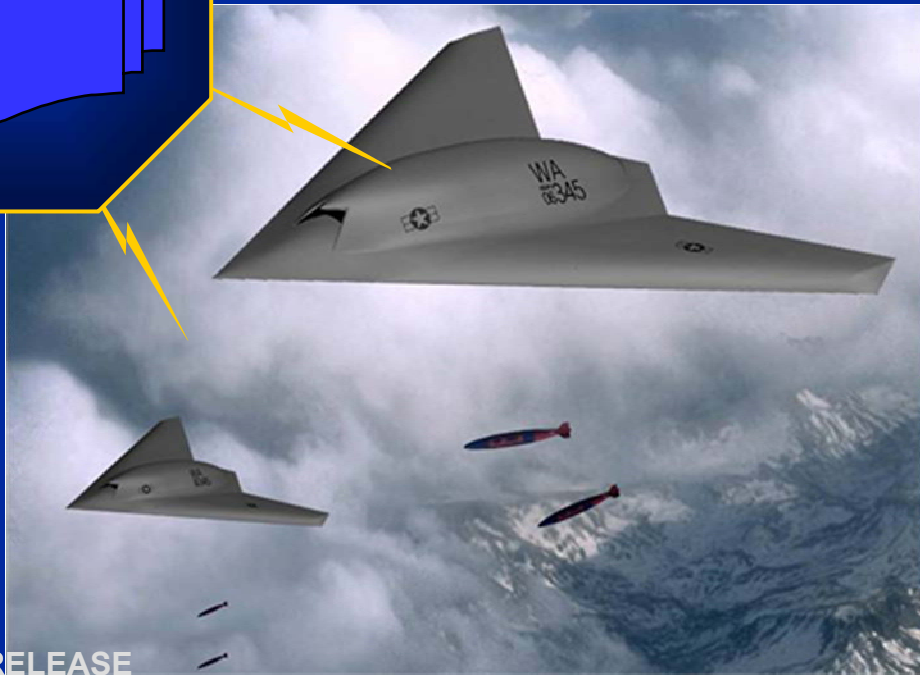
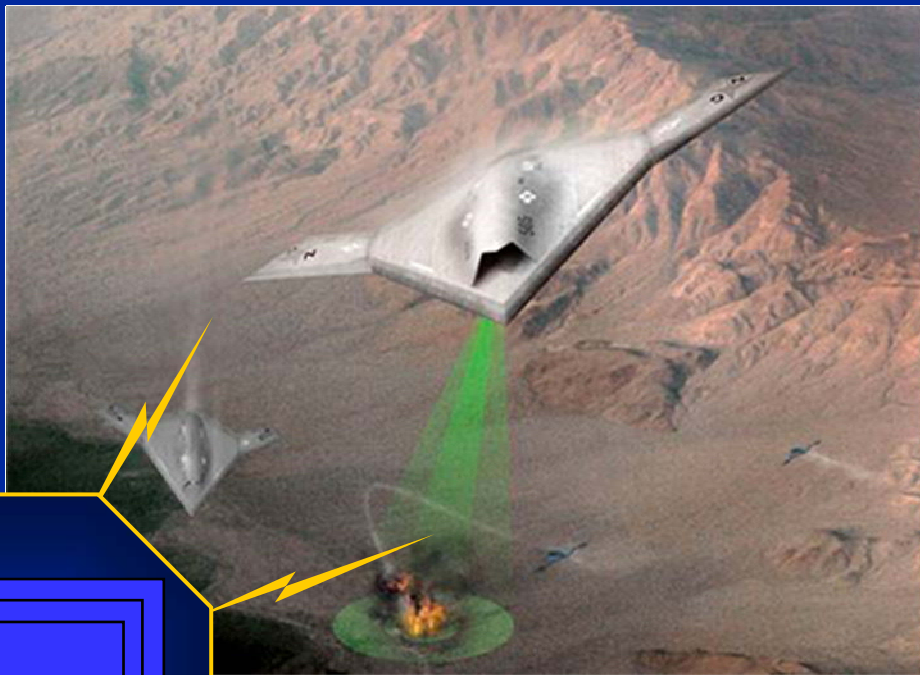


J-UCAS Office Structure



PUBLIC RELEASE

Distribution Statement A: Approved for Public Release #2139 – Distribution Unlimited.



PUBLIC RELEASE

Distribution Statement A: Approved for Public Release #2139 – Distribution Unlimited.

Agenda



| | | |
|--|----------------|-----------|
| Agenda Overview | Mr. Pitarys | 0800-0810 |
| J-UCAS Overview | Dr. Francis | 0810-0850 |
| Common Systems & Technology Overview & Common Operating System (COS) Overview | Mr. Pitarys | 0850-0945 |
| COS Integrator/Broker | Mr. Pitarys | 0945-1015 |
| Break | All | 1015-1045 |
| Integrator/Broker Solicitation | Mr. Bennington | 1045-1130 |
| Questions & Answers | All | 1130-1200 |
| Lunch | All | 1200-1300 |
| More Questions & Answers | All | 1300-1400 |
| Concluding Remarks, Wrap-up And Adjourn | All | 1400-1500 |

PUBLIC RELEASE

Distribution Statement A: Approved for Public Release #2139 – Distribution Unlimited.